J. Helminthol. Soc. Wash.
62(2), 1995, pp. 117–130

Digenetic Trematodes of Marine Fishes from Suva, Fiji: The Family Gyliauchenidae Ozaki, 1933

FUAD M. NAHHAS AND JEFF A. WETZEL
Department of Biological Sciences, University of the Pacific, Stockton, California 95211

ABSTRACT: Three new species of gyliauchenids are described from marine fishes taken at Suva, Fiji Islands: *Gyliauchen pomacentri* from *Pomacentrus philippinus, G. parapapillatus* from *Siganus virgatus,* and *G. zancli* from *Zanclus cornutus. Gyliauchen* sp. from *Siganus spinus* and *Apharyngogyliauchen* sp. from *Scarus ghobban* are described from immature specimens and classified to generic level. *Gyliauchen papillatus* of Durio and Manter (1969) nec Goto and Matsudaira (1918) and nec Goto (1919) is considered a synonym of *G. parapapillatus. Gyliauchen nahaensis* Ozaki, 1937, is reported from *Siganus punctatus* and *Zanclus cornutus,* both new locality records and the latter a new host record. A key to all 22 adult species of Gyliauchenidae and host-parasite and parasite-host lists are included as well as some observations on the zoogeography of the Gyliauchenidae.

KEY WORDS: digenetic trematodes, parasites, Gyliauchenidae, marine fishes, Fiji Islands.

Between 13 January and 7 February 1992, the senior author collected helminths of marine fishes at the Institute of Marine Resources, University of the South Pacific, Suva, Fiji Islands. Two previous collections of parasites of marine fishes from the Fiji Islands have been made: the first by Manter in 1951 (see Manter, 1953, 1961, 1963a, b, c; Manter and Prince, 1953), the second between 1979 and 1982 by the *Hatsutori Maru* and other fishing boats on charter to the government of New Zealand (see Lester et al., 1985). No gyliauchenids were reported in either study. The present paper deals with representatives of Gyliauchenidae Ozaki, 1933 (syn. Dissotrematidae Goto and Matsudaira, 1918).

To date, 19 species in 6 genera are known in the family Gyliauchenidae: *Gyliauchen* (8), *Paragyliauchen* (2), *Flagellotrema* (4), *Ichthyotrema* (1), *Leptobulbus* (1), and *Apharyngogyliauchen* (3). The description of 3 new species and 2 immature ones in this paper brings the total to 24.

Materials and Methods

A total of 236 fishes were obtained from several sources including traps, nets, spear fishing, and commercial fishermen. Except for a few fishes that were purchased, all were captured live on reefs and lagoons of Laucala Bay, Suva, a few miles from the Institute of Marine Resources. Fifty species representing 32 genera and 20 families were collected. Six species—*Pomacentrus philippinus* (family Pomacentridae), *Scarus ghobban* (family Scaridae), *Siganus punctatus, Siganus spinus, Siganus virgatus* (family Siganidae), and *Zanclus cornutus* (family Zanclidae)—harbored gyliauchenids. The fish were kept alive in tanks until shortly before examination. After removal from the host, the digeneans were washed in 0.7% saline, many studied alive before they were fixed in alcohol–formalin–acetic acid under slight coverslip pressure. The worms were then transferred to a dish, left in the fixative overnight, and stored in 70% ethanol. Most of the worms were stained with Semichon's acetocarmine, a few with aqueous Delafield hematoxylin, dehydrated in ascending series of isopropanol, cleared in methylsalicylate, rinsed in xylol, and mounted in Kleermount.

Measurements are expressed in millimeters except for eggs, which are in micrometers (μm). Sucker ratio was calculated from the mean of the length and the width and is expressed with the oral sucker taken as 1. Drawings of specimens obtained in this study were prepared by microprojection and details filled in through microscopic observations. Drawings of other species were made by tracing original figures. The number of specimens recovered from each infected fish and the number of fish examined are indicated next to each host species listed in the description.

Holotypes are deposited in the Parasite Collection of the United States National Museum (USNM), Beltsville, Maryland; vouchers of some species are in the Harold W. Manter Laboratory (HWML), University of Nebraska State Museum, Lincoln, and the British Museum of Natural History, BM(NH), London.

Fishes were identified by Johnson Seeto of the Institute of Marine Resources. References used included an unpublished manuscript on fishes of the Fiji Islands, Nelson (1984), Meyers (1989), and Randall et al. (1990).

Results

Gyliauchen pomacentri sp. n. (Fig. 1)

TYPE HOST: *Pomacentrus philippinus* Evermann and Seale (Pomacentridae) 1/1 of 1.

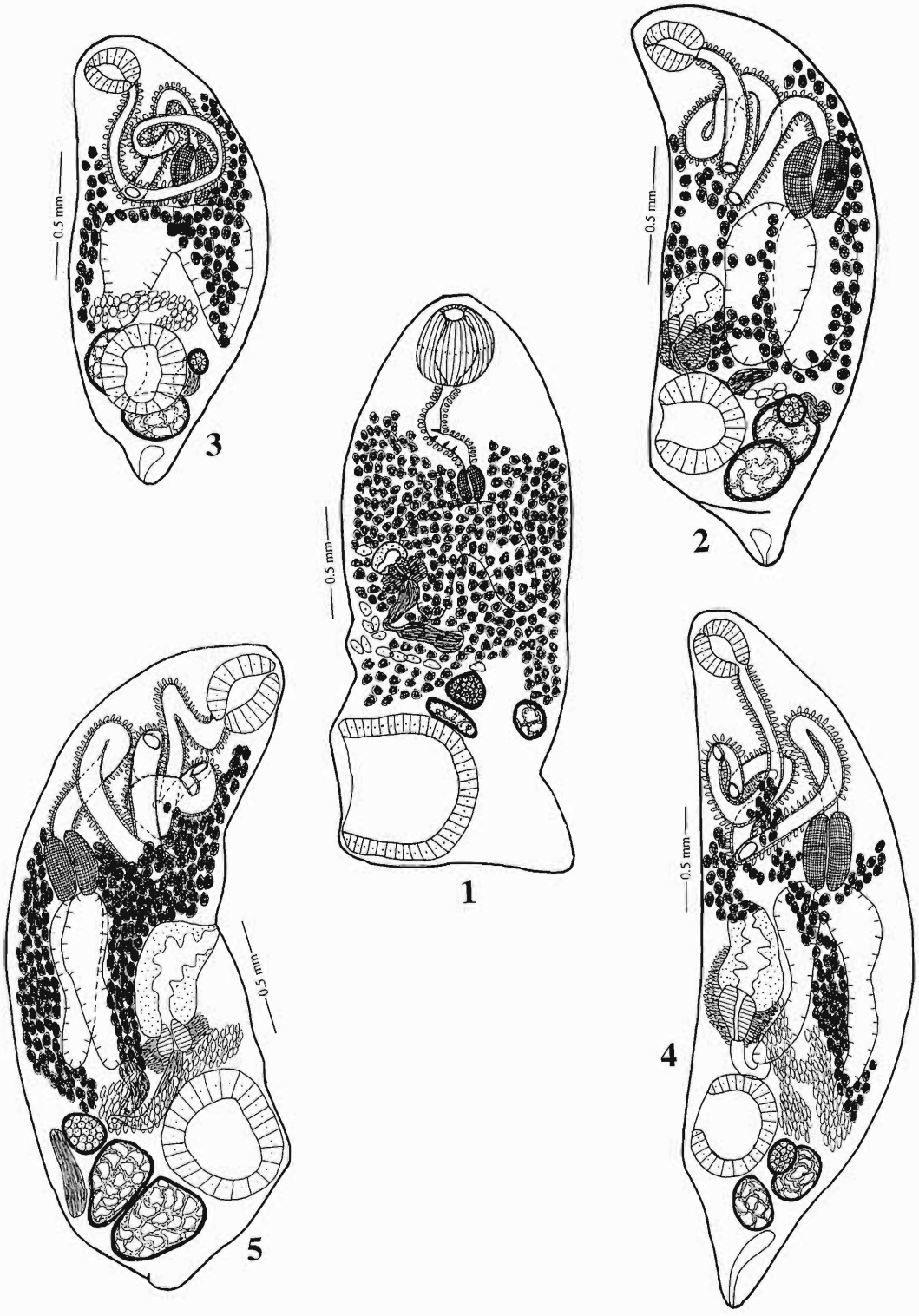
SITE IN HOST: Small intestine.

TYPE LOCALITY: Laucala Bay, Suva.

DATE OF COLLECTION: 3 February 1992.

HOLOTYPE: USNM Helm. Coll. No. 83915.

DESCRIPTION OF HOLOTYPE: Body broad, cylindrical, 2.50 long by 1.13 wide, rounded anteriorly, truncated posteriorly, with large excretory papilla projecting dorsally at level of ace-



Figures 1–5. 1. ***Gyliauchen pomacentri*** **sp. n. holotype from** ***Pomacentrus philippinus,*** **Suva, Fiji Islands. Ventral view. 2.** ***G. parapapillatus*** **sp. n. holotype from** ***Siganus virgatus,*** **Suva, Fiji Islands. Ventrolateral view. 3.** ***G. parapapillatus*** **sp. n. paratype from** ***Siganus virgatus,*** **Suva, Fiji Islands. Ventral view. 4.** ***G. parapapillatus*** **(Durio and Manter, 1969) from** ***Siganus lineatus,*** **Green Island, Queensland, Australia. Ventrolateral view. 5.** ***G. parapapillatus*** **(Durio and Manter, 1969) from** ***Siganus*** **sp., New Caledonia. Lateral view.**

tabulum. Cuticle thick and smooth. Oral sucker slightly subterminal, globular, 0.36 long by 0.37 wide. Ventral sucker cup-shaped, 0.69 long by 0.61 wide, at posterior end of body. Sucker ratio 1:1.78. Prepharynx 0.45 long by 0.10 wide or about one-fifth body length, sigmoid, surrounded by glands along entire length. Pharynx small, muscular, oblong, 0.21 long by 0.15 wide. Esophagus absent. Ceca 2, widely dilated, mostly in middle third of body.

Testes 2, symmetrical, anterior to acetabulum, right testis transversely elongate, 0.10 long by 0.23 wide, left testis subglobular, 0.14 long by 0.17 wide. Seminal vesicle bipartite, L-shaped, parts separated by narrow duct. Cirrus sac relatively small, well developed, muscular, containing ovoid pars prostatica and short cirrus. Prostatic cells well developed, surrounding junction of cirrus sac and anterior portion of seminal vesicle.

Ovary globular, pretesticular, 0.17 long by 0.20 wide. Seminal receptacle overlapping ovary, poorly stained, difficult to measure. Vitellaria follicular, extending from midprepharyngeal level, dorsally and ventrally, to near anterior level of gonads. Uterus short, preovarian, containing few eggs. Eggs 65–85 μm long by 38–45 μm wide.

Genital pore ventrolateral at level of cecal bifurcation. Excretory vesicle not observed, pore opening at tip of large posterodorsal excretory papilla. Lymphatic system present but details not determined.

REMARKS: *Gyliauchen pomacentri* may be distinguished from *G. caudatum* (syn. *Telotrema caudatum* Ozaki, 1933), the only other species in the genus with a relatively short prepharynx, by its body shape, greater sucker ratio, topography of gonads, and absence of a muscular sphincter near the genital opening.

When Ozaki (1933) described the genus *Telotrema* from the acanthurid *Xesurus scalprum*, he indicated that *Telotrema* can be differentiated from *Gyliauchen* by the configuration of the prepharynx, the assembly of the male parts, and the presence of a genital sphincter. Yamaguti (1934), however, stated that "*Telotrema caudatum*, Ozaki, 1933 is apparently congeneric with *Gyliauchen papillatus* (Goto and Matsudaira). It seems very probable that Ozaki misinterpreted the structure of the terminal genitalia, p. 529." Ozaki (1936a, b, 1937a, b) continued to refer to this species as *T. caudatum*. Winter (1960) agreed with Ozaki and reestablished the validity of *Telotrema*. The relatively short prepharynx compared to total body length in *G. pomacentri* may justify reestablishing *Telotrema* as a valid genus. However, a muscular genital sphincter is not evident, and in all other respects *T. caudatum* is typical of other species of *Gyliauchen*.

Gyliauchen parapapillatus sp. n. (Figs. 2–5)

G. papillatus of Durio and Manter (1969) nec *G. papillatus* (Goto and Matsudaira, 1918) Goto, 1919, new synonymy.

TYPE HOST: *Siganus virgatus* (Valenciennes) (Siganidae) 42/1 of 1.

SITE IN HOST: Small intestine.

TYPE LOCALITY: Laucala Bay, Suva.

DATE OF COLLECTION: 31 January 1992.

HOLOTYPE: USNM Helm. Coll. No. 83916.

PARATYPES: HWML 37619, BM(NH) 1994.6.14.3.

DESCRIPTION (based on 42 specimens and measurements on 17 mature ones; holotype measurements in parentheses): Body crescent-shaped in life and orange in color; fixed specimens somewhat convex dorsally, tapering gradually anteriorly, 1.43–2.18 (2.18) long by 0.40–0.83 (0.83) wide, with excretory papilla projecting posterodorsally. Cuticle thick and smooth. Oral sucker globular, slightly subterminal, 0.20–0.25 (0.24) long by 0.14–0.21 (0.21) wide. Ventral sucker globular, 0.28–0.36 (0.36) long by 0.22–0.31 (0.31) wide, near posterior end of body. Sucker ratio 1:1.28–1.59 (1.49). Prepharynx about 1.5 body length, convoluted, forming 3 or 4 coils, surrounded by glands along entire length. Pharynx oblong to cylindrical, muscular, 0.23–0.34 (0.31) long by 0.17–0.32 (0.24) wide. Esophagus absent. Ceca 2, mostly in midbody third, measuring about one-third to one-fourth body length.

Testes 2, globular, 0.14–0.30 (0.24–0.29) in diameter, oblique, dorsal to ventral sucker. Seminal vesicle bipartite, parts separated by narrow constriction. Cirrus sac well developed, containing ovoid prostatic vesicle and well-developed, muscular, eversible cirrus. Prostatic cells well developed, surrounding junction of cirrus sac and anterior portion of seminal vesicle.

Ovary globular, small compared to testes, dorsal to anterior testis or to junction of 2 testes, 0.04–0.19 (0.12) in diameter. Seminal receptacle globular to saccular, large, almost contiguous with ovary, 0.10–0.28 (0.17) long by 0.07–0.18 (0.11) wide. Vitellaria follicular, extending from midprepharyngeal region to near anterior level of

anterior testis. Uterus preovarian. Eggs yellow in life, 63–78 (73–78) μm long by 30–50 (38–40) μm wide in fixed specimens.

Genital pore ventral at level of intestinal bifurcation. Excretory bladder with short duct opening at tip of excretory papilla. Lymphatic system present, seen in sagittal sections as longitudinal canals extending from anterior to posterior end of body.

REMARKS: *Gyliauchen parapapillatus* (Figs. 2, 3) is most similar to *G. papillatus* (Goto and Matsudaira, 1918) Goto, 1919 (Figs. 18, 19), in the anterior extent of the vitellaria, which, in both, extend to at least the midlevel of the prepharynx. The Fijian specimens differ, however, in 2 major characters, a prepharynx that is longer than body length and the relatively larger size of the intestinal ceca compared to the body. We have examined and drawn 2 specimens of *G. papillatus* (Figs. 20, 21) (USNM 37889) deposited by Fischtal and Kuntz (1964) from *Anodontostoma chacunda* from Puerto Princesa, Palawan Island, Philippines. We have also examined and drawn 2 specimens reported as *G. papillatus* by Durio and Manter (1969) from *Siganus lineatus* (HWML "A274d"; Fig. 4) from Green Island, Queensland, Australia, and from *Siganus* sp. (HWML no 618; Fig. 5) from New Caledonia.

Based on the review of pertinent literature and the figures reproduced or drawn, it is evident that 2 groups exist: one group consisting of populations from Japanese and Palawan Island waters, the second of Fijian, New Caledonian, and Australian waters. The Australian (Fig. 4) and New Caledonian (Fig. 5) material share with the Fijian specimens the longer prepharynx and the relatively larger intestinal ceca. Fischtal and Kuntz's specimens (Figs. 20, 21) have a prepharynx shorter than body length and relatively smaller intestinal ceca. We consider *G. papillatus* of Durio and Manter a synonym of *G. parapapillatus* sp. n.

Ozaki (1937b) stated, "The degree of winding is variable according to species, and even in the same species it may vary over quite a wide range; so the topographical figure of the prepharynx if not presenting a major difference had better be neglected in identification, p. 175." Our observations do not support Ozaki's statement. In each of the 42 specimens of *G. parapapillatus,* which probably represent different infections, as evidenced by differences in size and maturity, the prepharynx is about 1.5 times that of body length.

One mature specimen from *Zanclus cornutus* is very similar in body shape to 2 others identified as *G. nahaensis* except for the absence of prepharyngeal glands, shorter prepharynx, and more anterior location of the ovary. The 3 specimens, recovered from the same host and processed at the same time, were not suspected to represent different species until the stained material was studied. The description of this worm as a new species follows.

Gyliauchen zancli sp. n. (Fig. 6)

TYPE HOST: *Zanclus cornutus* (Linnaeus) (Zanclidae) 1/1 of 2.

SITE IN HOST: Small intestine.

TYPE LOCALITY: Laucala Bay, Suva.

DATE OF COLLECTION: 6 February 1992.

HOLOTYPE: USNM Helm. Coll. No. 83917.

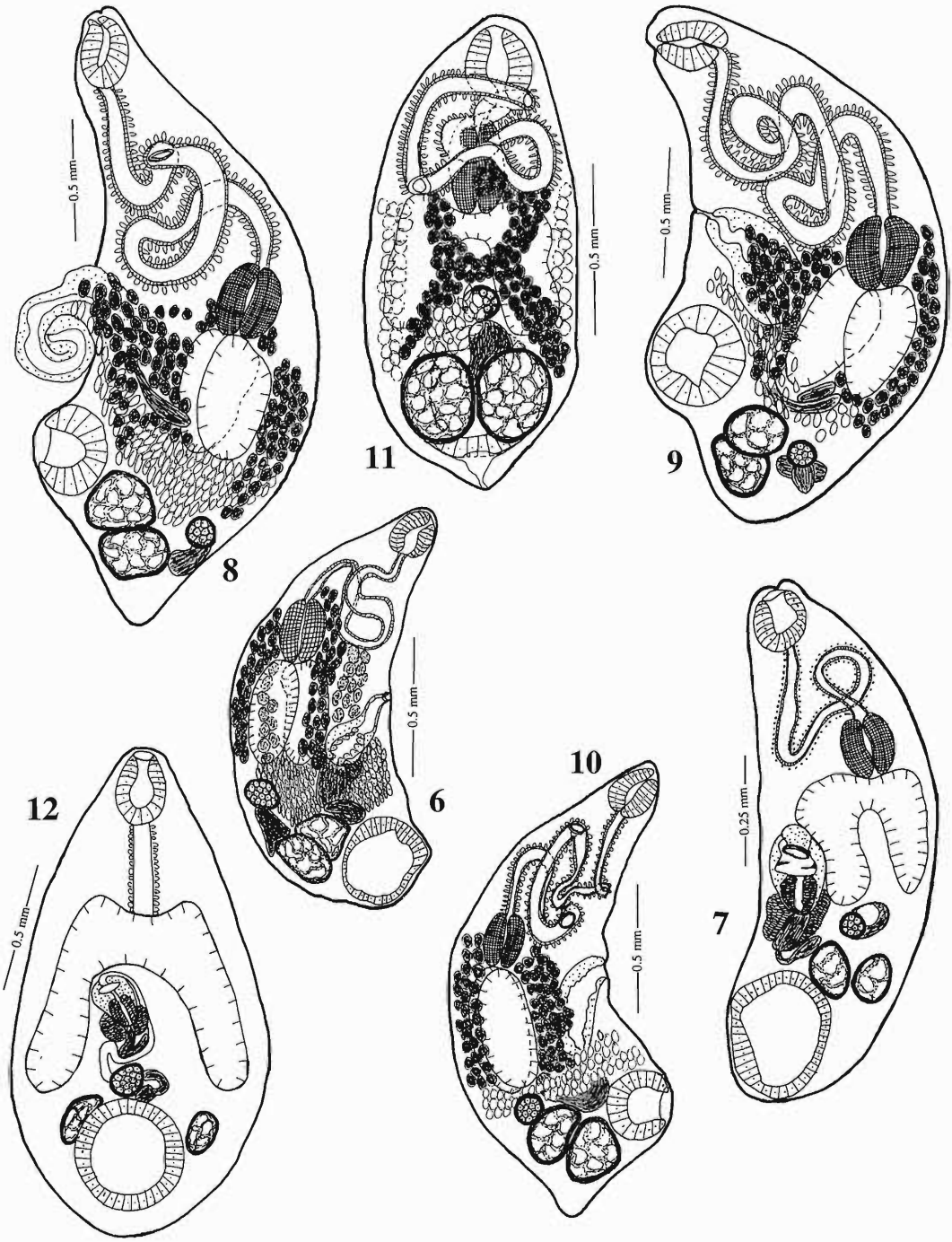
DESCRIPTION OF HOLOTYPE: Body crescent-shaped, 1.70 long by 0.65 deep. Cuticle thick and smooth. Oral sucker ovoid, slightly subterminal, 0.20 long by 0.16 wide. Ventral sucker globular, 0.33 long by 0.30 wide, at posterior end of body. Sucker ratio 1:1.76. Prepharynx thick-walled, convoluted, about three-quarters body length, not surrounded by glands. Pharynx oblong, muscular, 0.26 long by 0.15 wide. Esophagus absent. Ceca 2, about two-sevenths body length, occupying middle third of body.

Testes 2, slightly oblique; anterior testis subglobular, 0.26 long by 0.18 wide, left testis subglobular, 0.21 long by 0.18 wide. Seminal vesicle bipartite, saccular parts separated by constriction. Cirrus sac somewhat pyriform, well developed, containing ovoid pars prostatica and cirrus of equal length. Prostatic cells surrounding junction of cirrus sac and seminal vesicle.

Ovary globular, pretesticular, 0.14 long by 0.11 wide, between testes and intestinal ceca. Seminal receptacle not observed. Vitellaria follicular, extending just anterior to pharynx to posterior ends of ceca. Vitelline reservoir triangular, occupying space between testes and ovary. Uterus coiled, containing many eggs. Eggs yellow, ovoid, 55–85 μm long by 30–53 μm wide.

Genital pore ventral, near midbody level. Excretory papilla not evident. Lymphatic system not observed.

REMARKS: The only other species of *Gyliauchen* lacking prepharyngeal glands is *G. indicum* (Fig. 17). *Gyliauchen zancli* differs from *G. indicum* in its smaller size (1.70 by 0.65 com-



Figures 6–12. 6. ***Gyliauchen zancli*** **sp. n. holotype from** ***Zanclus cornutus,*** **Suva, Fiji Islands. Lateral view. 7.** ***Gyliauchen*** **sp. from** ***Siganus spinus,*** **Suva, Fiji Islands. Ventral view. 8.** ***G. nahaensis*** **Ozaki, 1937, from** ***Siganus punctatus,*** **Suva, Fiji Islands. Lateral view. 9.** ***G. nahaensis*** **Ozaki, 1937, from** ***Siganus punctatus,*** **Suva, Fiji Islands. Lateral view. 10.** ***G. nahaensis*** **Ozaki, 1937, from** ***Zanclus cornutus,*** **Suva, Fiji Islands. Lateral view. 11.** ***G. nahaensis*** **Ozaki, 1937, from** ***Siganus punctatus,*** **Suva, Fiji Islands. Dorsal view. 12.** ***Apharyngogyliauchen*** **sp. holotype from** ***Scarus ghobban,*** **Suva, Fiji Islands. Ventral view.**

pared to 2.11–2.40 by 0.72–0.88), relatively larger pharynx, and smaller testes. The testes in *G. zancli* are smaller than the ventral sucker; those of *G. indicum* are about the same size. The discovery of another species lacking prepharyngeal glands indicates that this feature is not necessarily a family characteristic even though the majority of species have them. There is no evidence in our specimen of any gland cells that have become exhausted and, therefore, would not stain. It should also be noted that in *G. oligoglandulosus,* Gu and Shen (1979) reported few gland cells surrounding the anterior portion of the prepharynx, but they are apparently absent around the more posterior part.

Gyliauchen sp. (Fig. 7)

HOST: *Siganus spinus* (Linnaeus) (Siganidae) 2/2 of 4.

SITE IN HOST: Small intestine.

LOCALITY: Laucala Bay, Suva.

DATE OF COLLECTION: 2 February 1992.

DEPOSITED SPECIMEN: USNM Helm. Coll. No. 83918.

DESCRIPTION (based on 2 specimens, 1 complete and 1 missing ventral sucker): Body convex dorsally, slightly concave ventrally, tapering anteriorly, rounded posteriorly, 1.33 long by 0.40–0.45 in greatest width. Cuticle smooth. Oral sucker globular, subterminal, 0.12–0.14 in diameter. Ventral sucker globular, 0.30 long by 0.25 wide, at posterior end of body. Sucker ratio 1:2.17. Prepharynx with single loop, about three-fourths body length, surrounded by diffuse glands along entire length. Pharynx muscular, ovoid, 0.16–0.19 long by 0.12–0.13 wide. Esophagus absent. Ceca 2, about two-ninths body length, occupying middle third of body.

Testes 2, symmetrical, anterodorsal to acetabulum, right testis globular, 0.13 long by 0.11 wide, left testis globular, 0.12 long by 0.10 wide. Seminal vesicle bipartite, larger anterior segment separated by narrow duct from posterior portion. Cirrus sac containing large, coiled cirrus and ovoid pars prostatica; prostatic cells surrounding junction of cirrus sac and anterior portion of seminal vesicle.

Ovary globular, pretesticular, 0.06 in diameter. Seminal receptacle ovoid, 0.15 long by 0.10 wide, overlapping ovary. Vitellaria not observed. Uterus preovarian. One collapsed egg 73 μm long by 30 μm wide.

Genital pore ventral to cecal bifurcation. Excretory system not observed. Excretory papilla and lymphatic system not evident.

REMARKS: *Gyliauchen* sp. from *Siganus spinus* agrees well with other species of *Gyliauchen* in general body shape and internal anatomy. However, it cannot be further classified because the vitellaria, which are an important specific character, are not evident.

Gyliauchen nahaensis Ozaki, 1937 (Figs. 8–11, 13, 14)

HOSTS: *Siganus punctatus* (Forster) (Siganidae) 189/1 of 2; *Zanclus cornutus* (Linnaeus) (Zanclidae) 2/1 of 2, new host record.

SITE IN HOSTS: Small intestine.

LOCALITY: Laucala Bay, Suva.

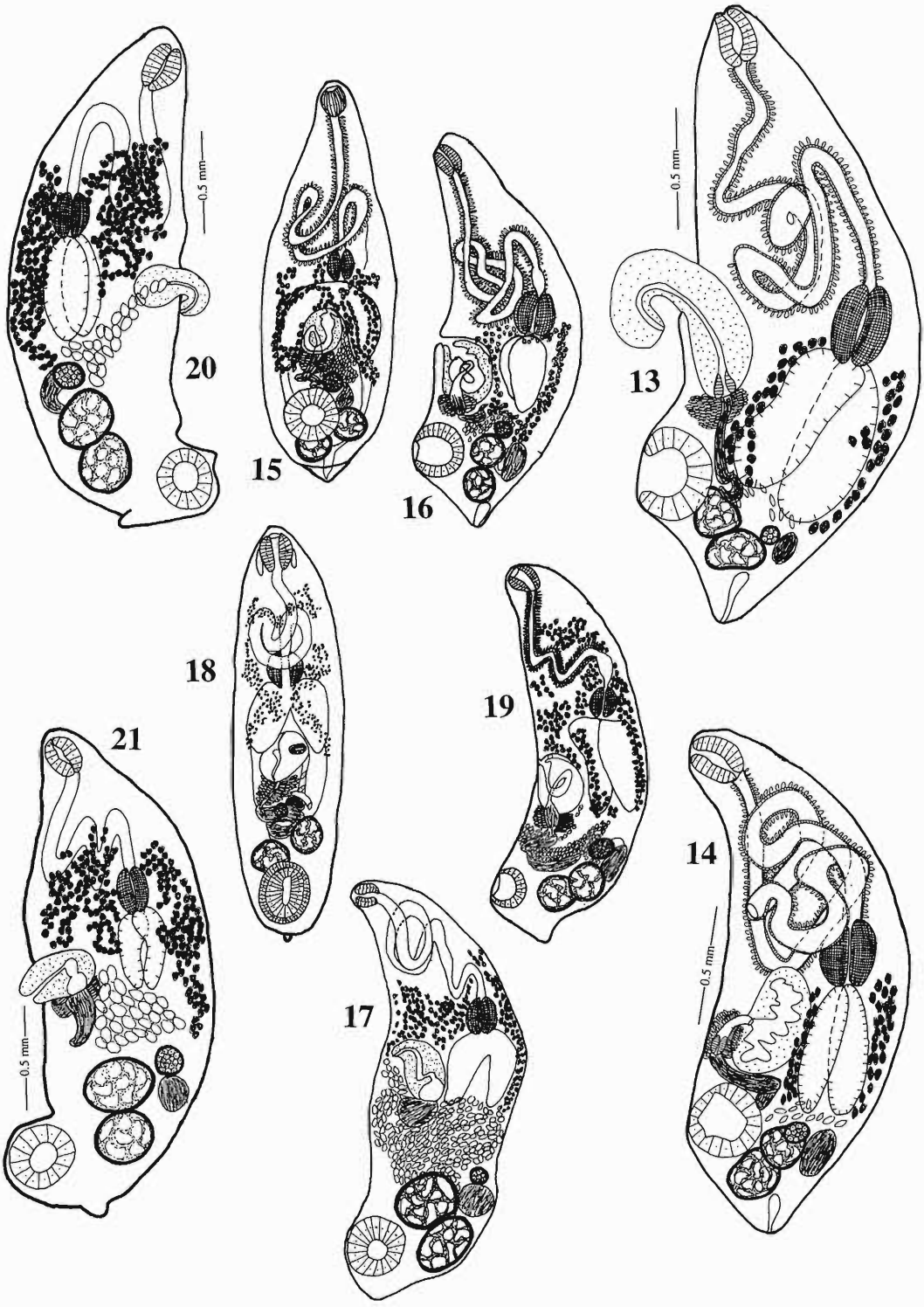
DATE OF COLLECTION: 27 January 1992; 6 February 1992.

DEPOSITED SPECIMENS: USNM Helm. Coll. No. 83920, HWML 37618, BM(NH) 1994.6.14.2.

DESCRIPTION (based on all mature and immature specimens from both host species; measurements on 33 mature specimens from *S.*

→

Figures 13–21. 13. *Gyliauchen nahaensis* Ozaki, 1937, from *Siganus chrysospilos* (=*S. punctatus*), locality unknown. Lateral view. 14. *G. nahaensis* Ozaki, 1937, from *Siganus chrysospilos* (=*S. punctatus*), locality unknown. Ventral view. 15. *G. nahaensis* Ozaki, 1937, from *Siganus punctatus,* Naha, Japan (after Ozaki, 1937b). Ventral view. 16. *G. nahaensis* Ozaki, 1937, from *Siganus punctatus,* Naha, Japan (after Ozaki, 1937). Lateral view. 17. *G. indicum* Gupta and Tandon, 1985, from *Engraulis hamiltoni,* Puri, Orissa, India (after Gupta and Tandon, 1985). Ventral view. 18. *G. papillatus* (Goto and Matsudaira, 1918) from *Siganus fuscescens,* Inland Sea and Pacific Coast of Mie and Wakayama prefectures, Japan (after Goto and Matsudaira, 1918). Ventral view; shows no gland cells surrounding prepharynx—as in original. 19. *G. papillatus* (Goto and Matsudaira, 1918) from *Siganus* sp., Pacific Coast and Inland Sea of Japan (after Ozaki, 1937b). Lateral view; shows gland cells surrounding prepharynx—as in original. 20. *G. papillatus* (Goto and Matsudaira, 1918) from *Anodontostoma chacunda,* Puerto Princesa, Palawan Island, Philippines. Lateral view; gland cells surrounding prepharynx not shown. 21. *G. papillatus* (Goto and Matsudaira, 1918) from *Anodontostoma chacunda,* Puerto Princesa, Palawan Island, Philippines. Lateral view; gland cells surrounding prepharynx not shown.



punctatus and 1 from *Z. cornutus*): In life, specimens were orange in color and crescent-shaped; fixed specimens convex dorsally, slightly concave ventrally. Body 1.30–2.45 long by 0.70–1.13 wide, greatest width at or near acetabular level; posterior end broadly pointed forming short, sometimes inconspicuous, excretory papilla. Cuticle thick and smooth. Oral sucker globular, slightly subterminal, 0.20–0.28 long by 0.17–0.24 wide. Ventral sucker globular, 0.27–0.43 long by 0.26–0.45 wide, near posterior end of body. Sucker ratio 1:1.45–1.95. Prepharynx long, convoluted, forming 3–4 coils, measuring about 1.5–2 times body length, surrounded by glands along entire length. Pharynx ovoid to cylindrical, muscular, 0.22–0.39 long by 0.18–0.28 wide. Esophagus absent. Ceca 2, occupying third quarter of body.

Testes 2, usually oblique to slightly tandem, rarely symmetrical, subglobular, dorsal or posterodorsal to ventral sucker, 0.18–0.33 long by 0.13–0.33 wide. Seminal vesicle large, bipartite, parts separated by constriction often concealed by uterus. Cirrus sac well developed, containing ovoid to cylindrical pars prostatica, and large, muscular, eversible cirrus. Numerous prostatic cells surrounding base of cirrus sac at junction with seminal vesicle.

Ovary globular, very small compared to testes, dorsal to anterior testis or junction of testes, 0.08–0.20 long by 0.07–0.15 wide. Seminal receptacle usually spherical, saccate, rarely coiled, larger than and posterodorsal to ovary, 0.10–0.52 long by 0.08–0.22 wide. Vitellaria follicular, extending from about midlevel of pharynx to midlevel of anterior testis, confluent dorsally just posterior to cecal bifurcation. Uterus preovarian. Eggs yellow in life, numerous, 63–85 μm long by 35–58 μm wide in fixed specimens.

Genital pore midventral near level of cecal bifurcation. Excretory pore opening at posterior end of body. Lymphatic system present, seen in sagittal sections as longitudinal canals extending from near posterior end of body to near oral sucker.

REMARKS: This is the fourth report of *Gyliauchen nahaensis* and the first outside of Japanese waters. In describing *G. nahaensis,* Ozaki (1937b) distinguished it from the other species by the conical shape of the body, absence of excretory papilla, and the postpharyngeal vitellaria; from both *G. papillatus* and *G. tarachodes* by the longer and more convoluted prepharynx, the subterminal acetabulum, and the testes lying on the posterodorsal side of the body. The Fijian specimens from *Siganus punctatus* (Figs. 8, 9, 11) and *Zanclus cornutus* (Fig. 10) are remarkably similar to 2 specimens (HWML 31261) (Figs. 13, 14) labeled *G. nahaensis* from *Siganus chrysospilos* (=*S. punctatus*) borrowed from the HWML, University of Nebraska. Unfortunately, these specimens, part of a gift to the Manter Laboratory, were labelled only with parasite and host; the geographic origin is unknown. They do, however, share a common host with the Fijian material and agree with the descriptions and measurements provided by Ozaki (1937b) and Yamaguti (1942, 1953).

The specific characters of this species are Vitellaria not extending into prepharyngeal region of body; testes usually oblique or tandem in lateral view, rarely symmetrical in ventral view; and a convoluted prepharynx, 1.5–2 times body length. An excretory papilla is present but poorly developed.

The specimen represented by Figure 11 is a dorsal view and in agreement with the general morphology and measurements of *G. nahaensis* except for the arrangement of the gonads; this specimen (1 out of 191 collected) was specifically manipulated and excessively flattened during live observation to determine the location of the genital pore and the relationship of the internal organs to each other.

The present finding represents a new locality record and includes a new host record.

Apharyngogyliauchen sp. (Fig. 12)

HOST: *Scarus ghobban* Forsskål (Scaridae) 1/1 of 2.

SITE IN HOST: Small intestine.

TYPE LOCALITY: Laucala Bay, Suva.

DATE OF COLLECTION: 27 January 1992.

DEPOSITED SPECIMEN: USNM Helm. Coll. No. 83919.

DESCRIPTION (based on a single immature specimen): Body pyriform, 2.03 long by 1.05 wide, greatest width just anterior to ventral sucker. Cuticle smooth. Oral sucker slightly subterminal, somewhat pear-shaped, 0.31 long by 0.24 wide. Ventral sucker spherical, 0.46 in diameter, near posterior end of body. Sucker ratio 1:1.67. Esophagus straight, 0.37 long by 0.10 wide or about one-fifth body length, surrounded by glands

Table 1. Host specificity of selected trematode families for species of marine fishes. Families 1-8 are from Curaçao and Jamaica; family 9 is from various parts of the world.

Families of trematodes	Number of species	Number of host species					
		1	2	3	4	5	6+
1. Acanthocolpidae	10	6 (60.0%)	1 (10.0%)	1 (10.0%)		1 (10.0%)	1 (10.0%)
2. Bucephalidae	15	11 (73.3%)	2 (13.3%)	1 (6.7%)			1 (6.7%)
3. Fellodistomatidae	12	8 (66.7%)	3 (25.0%)				1 (8.3%)
4. Hemiuridae	23	10 (43.5%)	2 (8.7%)	5 (21.7%)			6 (26.1%)
5. Haplosplanchnidae	11	5 (45.5%)	1 (9.1%)	1 (9.1%)		3 (27.3%)	1 (9.1%)
6. Lepocreadiidae	36	25 (69.4%)	7 (19.4%)	2 (5.6%)	1 (2.8%)	1 (2.8%)	
7. Monorchiidae	17	10 (58.8%)	3 (17.6%)	2 (11.8%)			2 (11.8%)
8. Opecoelidae	21	12 (57.1%)	5 (23.8%)	2 (9.5%)			2 (9.5%)
9. Gyliauchenidae	24	12 (50.0%)	4 (16.7%)	4 (16.7%)	3 (12.5%)	1 (4.2%)	

along entire length. Pharynx absent. Ceca 2, occupying middle third of body.

Testes 2, symmetrical, 1 on each side of anterior half of acetabulum; right testis elongate, 0.20 long by 0.10 wide; left testis ovoid, 0.13 long by 0.10 wide. Seminal vesicle tubular and curved. Cirrus sac tapering posteriorly, enclosing ovoid pars prostatica and cirrus; prostatic cells surrounding junction of cirrus sac with seminal vesicle.

Ovary ovoid, 0.16 long by 0.13 wide, just anterior to acetabulum. Seminal receptacle to left of ovary: anterior portion tubular, curved; posterior portion ovoid. Vitellaria undeveloped. Uterus extending from ovary laterally along left side of cirrus sac to genital atrium. Eggs not present.

Genital pore posterior to intestinal bifurcation, dextral to median line. Excretory system not observed. Excretory papilla absent. Wide canals, extending laterally along both sides from the posterior end to the anterior region of the body, are evident and probably represent a lymphatic system.

REMARKS: *Apharyngogyliauchen* sp. from *Scarus ghobban* agrees well with other species of *Apharyngogyliauchen* in general body shape, internal anatomy, and the absence of a pharynx. However, it cannot be further classified because it is immature, lacking both eggs and vitellaria.

Discussion

The present survey, part of a collection made during a 3-wk period from 13 January to 7 February 1992 by the senior author, is the third for the Fiji Islands and the second for Suva. In 1951, Manter examined 44 species of fish and recovered 35 species of digenetic trematodes (see Manter, 1953, 1961, 1963a, b, c; Manter and Prince, 1953); the second was reported by Lester et al. (1985) based on collections by the *Hatsutori Maru* and other fishing boats on charter to the government of New Zealand. This collection dealt with parasites of the skipjack, *Katsuwonus pelamis,* captured in various locations in the central and western Pacific including Fijian waters. No gyliauchenids were reported in either study. It should be noted, however, that none of the fish species harboring gyliauchenids in the Nahhas collection were examined by either Manter or Lester.

The present study adds 3 new species to the family Gyliauchenidae and describes, but does not name, 2 additional immature forms, for a total of 24; it also extends the geographic distribution of 1 known species, *G. nahaensis,* to Fijian waters.

Present knowledge indicates that gyliauchenids are widely scattered in the Indo-Pacific region, an area that stretches from the coast of East Africa to the easternmost islands of Oceania, as well as to Hawaii and along the Pacific coast of Mexico. Recently, Cribb et al. (1994) reported recovery of at least 9 species of gyliauchenids from Heron Island, Great Barrier Reef. There are no reports of any gyliauchenids from other parts of the world.

One principle of parasitism suggests that host specificity is related to zoogeography because, by definition, host specificity implies a restricted distribution of a parasite to certain particular host species (Manter, 1957, 1967). Another principle, at least as it applies to digenetic trematodes, is that this group of parasites tends to be more host-specific in their molluscan than in their vertebrate hosts. Consequently, even though a

Table 2. Host specificity of selected trematode families for genera of marine fishes. Families 1-8 are from Curaçao and Jamaica; family 9 is from various parts of the world.

Families of trematodes	Number of species	Number of host genera					
		1	2	3	4	5	6+
1. Acanthocolpidae	10	8 (80.0)	1 (10.0%)			1 (10.0%)	
2. Bucephalidae	15	14 (93.3%)		1 (6.7%)			
3. Fellodistomatidae	12	11 (91.7%)			1 (8.3%)		
4. Hemiuridae	23	14 (60.9%)	2 (8.7%)	1 (4.3%)		2 (8.7%)	4 (17.4%)
5. Haplosplanchnidae	11	7 (63.6%)	2 (18.2%)	1 (9.1%)	1 (9.1%)		
6. Lepocreadiidae	36	34 (94.4%)	1 (2.8%)	1 (2.8%)			
7. Monorchiidae	17	11 (64.7%)	5 (29.4%)			1 (5.9%)	
8. Opecoelidae	21	19 (90.5%)				1 (4.8%)	1 (4.8%)
9. Gyliauchenidae	24	14 (58.3%)	6 (25.0%)	4 (16.7%)			

species of fish may be widely distributed, its parasites are not expected to be similar except in the region where both the definitive and intermediate hosts occur together. It is not the intention of this paper to discuss zoogeography or host specificity in any detail, but a few observations on the family Gyliauchenidae are pertinent.

The 24 species of gyliauchenids, described or reported so far, are known from 42 species of fish representing 13 families (Tables 4, 5). Manter (1957) reviewed and summarized the extent to which digenetic trematodes as a group have been reported from 1 or more species of marine fishes in Tortugas, the Mediterranean, the British Isles, and Japan. Nahhas and Cable (1964) compared their data from Curaçao and Jamaica to that of Manter; more recently, Dyer et al. (1985, 1988, 1992), Barker et al. (1994), and Cribb et al. (1994) have made similar studies. All the preceding data suggest a certain degree of host specificity for digenetic trematodes of marine fishes but do not consider the differences among trematode families. Because the present paper deals only with the family Gyliauchenidae, it would be relevant to make such a comparison using 9 digenean families, each represented by 10 or more species from Curaçao and Jamaica. The data extracted from Nahhas and Cable (1964) along with the data on the family Gyliauchenidae are shown in Tables 1–3.

At the host species level (Table 1), 50% of the species of gyliauchenids show specificity to a single host species, 16.7% to 2, 16.7% to 3, 12.5% to 4, and 4.2% to 5. The data from Curaçao and Jamaica suggest that the greatest specificity to 1 host is seen in the bucephalids (73.3%), followed by lepocreadiids (69.4%), fellodistomatids (66.7%), and progressively less for the other trematodes, with least host specificity for the haplosplanchnids (45.5%) and the hemiurids (43.5%). Compared to these families, the gyliauchenids are among the least host-specific except for the haplosplanchnids and hemiurids.

When the data are considered at the level of the host genus (Table 2), the same families that show highest and lowest specificity at the host

Table 3. Host specificity of selected trematode families for families of marine fishes. Families 1-8 are from Curaçao and Jamaica; family 9 is from various parts of the world.

Families of trematodes	Number of species	Number of host families					
		1	2	3	4	5	6+
1. Acanthocolpidae	10	9 (90.0%)			1 (10.0%)		
2. Bucephalidae	15	15 (100%)					
3. Fellodistomatidae	12	11 (91.7%)	1 (8.3%)				
4. Hemiuridae	23	16 (69.6%)	1 (4.3%)	3 (13.0%)	1 (4.3%)		2 (8.6%)
5. Haplosplanchnidae	11	10 (90.9%)			1 (9.1%)		
6. Lepocreadiidae	36	34 (94.4%)	2 (5.6%)				
7. Monorchiidae	17	14 (82.4%)	2 (11.8%)	1 (5.9%)			
8. Opecoelidae	21	19 (90.5%)	1 (4.8%)				1 (4.8%)
9. Gyliauchenidae	24	16 (66.7%)	6 (25.0%)	2 (8.3%)			

Table 4. Host-parasite list.

Family Acanthuridae
Acanthurus sandvicensis Streets
1. *Flagellotrema potteri*
Acanthurus sp.
1. *Gyliauchen ozakii*
Xesurus punctatus Gill
1. *Ichthyotrema vogelsangi*
Xesurus scalprum (Cuvier and Valenciennes)
1. *Gyliauchen caudatus*
2. *Flagellotrema convolutum*
Family Blenniidae
Plagiotremus tapeinosoma (Bleeker)
1. *Paragyliauchen chaetodontis*
Family Chaetodontidae
Chaetodon corallicola Snyder
1. *Flagellotrema chaetodontis*
Chaetodon fremblii Bennet
1. *Flagellotrema chaetodontis*
Chaetodon miliaris Quoy and Gaimard
1. *Flagellotrema chaetodontis*
Chaetodon multicintus Garrett
1. *Flagellotrema chaetodontis*
Chaetodon sp.
1. *Paragyliauchen chaetodontis*
Family Dorosomidae
Anodontostoma (*Dorosoma*) *chacunda* (Fowler and Bean)
1. *Gyliauchen papillatus*
Family Engraulidae
Engraulis hamiltoni (Cuvier and Valenciennes)
1. *Gyliauchen indicum*
Family Harpodontidae
Harpodon nehereus Ham
1. *Gyliauchen ozakii*
Family Labridae
Anampses caeruleopunctatus Rüppell
1. *Apharyngogyliauchen callyodontis*
Cirrhilabrus sp.
1. *Apharyngogyliauchen opisthovarius*
Family Pomacanthidae
Arusetta sextriatus (Kuhl and VanHassett)
1. *Paragyliauchen arusettae*
Centropyge ferrugatus Randall and Burgess
1. *Flagellotrema convolutum*
Centropyge heraldi Woods and Schultz
1. *Paragyliauchen arusettae*
Centropyge potteri (Jordan and Metz)
1. *Flagellotrema potteri*
2. *Flagellotrema centropygis*
Holacanthus septentrionalis Temminck and Schlegel
1. *Paragyliauchen chaetodontis*
Family Pomacentridae
Pomacentrus philippinus Evermann and Seale
1. *Gyliauchen pomacentri* sp. n.
Family Scaridae
Calotomus sandvicensis (Valenciennes)
1. *L. magnacirratus*
Pseudoscarus harid Forsskål
1. *Apharyngogyliauchen callyodontis*
2. *Gyliauchen volubilis*
Scarus dubius Bennet
1. *Leptobulbus magnacirratus*

Table 4. Continued.

Scarus ghobban Forsskål
1. *Apharyngogyliauchen* sp.
Scarus sordidus Forsskl
1. *Leptobulbus magnacirratus*
2. *Apharyngogyliauchen scarustis*
Scarus (=*Callyodon*) sp.
1. *Apharyngogyliauchen callyodontis*
2. *Leptobulbus magnacirratus*
Family Siganidae
Amphacanthus sigan Rüppell
1. *Gyliauchen volubilis*
Siganus fuscescens (Houttuyn)
1. *Gyliauchen papillatus*
Siganus guttatus (Bloch)
1. *Gyliauchen oligoglandulosus*
Siganus lineatus (Valenciennes)
1. *Gyliauchen parapapillatus* sp. n.
Siganus (=*Teuthis*) *oramin* (Schneider)
1. *Gyliauchen ozakii*
Siganus punctatus (Forster)
1. *Gyliauchen nahaensis*
Siganus spinus (Linnaeus)
1. *Gyliauchen* sp.
Siganus (=*Lo*) *unimaculatus* (Evermann and Seale)
1. *Gyliauchen nahaensis*
Siganus vermiculatus (Valenciennes)
1. *Gyliauchen ozakii*
Siganus virgatus (Valenciennes)
1. *Gyliauchen parapapillatus* sp. n.
Siganus (=*Teuthis*) sp.
1. *Gyliauchen nahaensis*
Siganus sp.
1. *Gyliauchen papillatus*
Siganus sp.
1. *Gyliauchen parapapillatus* sp. n.
Family Tachysuridae
Tachysurus sp.
1. *Gyliauchen tarachodes*
Family Zanclidae
Zanclus cornutus (Linnaeus)
1. *Gyliauchen nahaensis*
2. *Gyliauchen zancli* sp. n.

species level show a similar trend at the host genus level; the lowest specificity is seen in the families Haplosplanchnidae and Hemiuridae. The gyliauchenids, with a specificity of 58.9%, are the least host-specific among the 9 families.

When the data are considered at the level of host family (Table 3), host specificity is greater than 90.0% for all the families except Monorchiidae (82.4%), Hemiuridae (69.4%), and Gyliauchenidae (66.7%). Thus, gyliauchenids are among the least host-specific at all 3 levels.

Based on a review of the literature, a key to all adult species and host-parasite and parasite-host lists are provided.

Table 5. Parasite-host list.

Subfamily Apharyngogyliaucheninae Yamaguti, 1942
Genus *Apharyngogyliauchen* Yamaguti, 1942
A. callyodontis Yamaguti, 1942
1. *Anampses caeruleopunctatus*
2. *Pseudoscaris harid*
3. *Scarus* (=*Callyodon*) sp.
A. opisthovarius Gu and Shen, 1983
1. *Cirrhilabrus* sp.
A. scarustis Gu and Shen, 1983
1. *Scarus sordidus*
Apharyngogyliauchen sp.
1. *Scarus ghobban*
Subfamily Gyliaucheninae Fukui, 1929
Genus *Flagellotrema* Oazki, 1936
F. centropygis Yamaguti, 1970
1. *Centropyge potteri*
F. chaetodontis (Manter and Pritchard, 1962) Yamaguti, 1970
1. *Chaetodon corallicola*
2. *Chaetodon fremblii*
3. *Chaetodon miliaris*
4. *Chaetodon multicintus*
F. convolutum Ozaki, 1936
1. *Xesurus scalprum*
2. *Centropyge ferrugatus*
F. potteri Yamaguti, 1970
1. *Centropyge potteri*
2. *Acanthurus sandvicensis*
Genus *Gyliauchen* Nicoll, 1915
G. caudatus (Ozaki, 1933)
1. *Xesurus scalprum*
G. indicum Gupta and Tandon, 1985
1. *Engraulis hamiltoni*
G. nahaensis Ozaki, 1937
1. *Siganus punctatus*
2. *Siganus* (=*Lo*) *unimaculatus*
3. *Siganus* (=*Teuthis*) sp.
4. *Zanclus cornutus*
G. oligoglandulosus Gu and Shen, 1979
1. *Siganus guttatus*
G. ozakii Srivastava, 1938
1. *Acanthurus* sp.
2. *Harpodon nehereus*
3. *Siganus* (=*Teuthis*) *oramin*
4. *Siganus vermiculatus*
G. papillatus (Goto and Matsudaira, 1918) Goto, 1919
1. *Anodontostoma chacunda*
2. *Siganus fuscescens*
3. *Siganus* sp.
G. parapapillatus sp. n.
1. *Siganus lineatus*
2. *Siganus virgatus*
3. *Siganus* sp.
Gyliauchen pomacentri sp. n.
1. *Pomacentrus philippines*
G. tarachodes Nicoll, 1915
1. *Tachysurus* sp.
G. volubilus Nagaty, 1956
1. *Amphacanthus sigan*
2. *Pseudoscarus harid*

Table 5. Continued.

Gyliauchen zancli sp. n.
1. *Zanclus cornutus*
Gyliauchen sp.
1. *Siganus spinus*
Genus *Ichthyotrema* Caballero and Bravo-Hollis, 1953
I. vogelsangi Caballero and Bravo-Hollis, 1953
1. *Xesurus punctatus*
Genus *Leptobulbus* Manter and Pritchard, 1962
L. magnacirratus Manter and Pritchard, 1962
1. *Calotomus sandvicensis*
2. *Scaridea zonarcha*
3. *Scarus dubius*
4. *Scarus sordidus*
5. *Scarus* (=*Callyodon*) sp.
Genus *Paragyliauchen* Yamaguti, 1934
P. arusettae Machida, 1984
1. *Arusetta sextriatus*
2. *Centropyge heraldi*
P. chaetodontis Yamaguti, 1934
1. *Chaetodon* sp.
2. *Holacanthus septentrionalis*
3. *Plagiotremus tapeinosoma*

Key to Species of the Family Gyliauchenidae

1a. Pharynx absent 2
1b. Pharynx present 4
2a. Testes larger than ventral sucker; ovary anterior to ventral sucker ..... *Apharyngogyliauchen callyodontis*
2b. Testes about same size or smaller than ventral sucker; ovary dorsal to ventral sucker 3
3a. Testes about same size as ventral sucker; ovary intertesticular ..... *Apharyngogyliauchen opisthovarius*
3b. Testes much smaller than ventral sucker; ovary pretesticular ..... *Apharyngogyliauchen scarustis*
4a. Pharynx poorly developed ..... *Leptobulbus magnacirratus*
4b. Pharynx well developed 5
5a. Testes symmetrical and posterior to ventral sucker 6
5b. Testes symmetrical, oblique, or tandem and anterodorsal to posterodorsal to ventral sucker 7
6a. Vitellaria follicular; genital pore anterior to cecal bifurcation ..... *Paragyliauchen chaetodontis*
6b. Vitellaria ramiform; genital pore posterior to cecal bifurcation .. *Paragyliauchen arusettae*
7a. Prepharynx straight; ovary greatly posttesticular ..... *Ichthyotrema vogelsangi*
7b. Prepharynx sigmoid, coiled, or convoluted; ovary pre-, inter-, or slightly posttesticular 8
8a. Ovary intertesticular or slightly posttesticular; testes anterior to ventral sucker 9

8b. Ovary pretesticular or dorsal to testes; testes anterior, at same level, or posterior to ventral sucker 12
9a. Pharynx at least as large as ventral sucker .. .. *Flagellotrema centropygis*
9b. Pharynx smaller than ventral sucker 10
10a. Genital pore at level of posterior end of ceca ..... *Flagellotrema convolutum*
10b. Genital pore at about level of cecal bifurcation 11
11a. Testes smaller than pharynx .... *Flagellotrema chaetodontis*
11b. Testes about same size or larger than pharynx ..... *Flagellotrema potteri*
12a. Prepharynx relatively short and slightly sinuous 13
12b. Prepharynx long and coiled 14
13a. Testes dorsal to ventral sucker with 1 testis located in the basal part of the excretory papilla; oral sucker slightly larger than pharynx; genital sphincter present .... *Gyliauchen caudatum*
13b. Testes anterodorsal to ventral sucker; oral sucker at least twice the diameter of the pharynx; genital sphincter absent .... *Gyliauchen pomacentri* sp. n.
14a. Prepharynx surrounded by glands 15
14b. Prepharynx not surrounded by glands 16
15a. Vitellaria usually not extending anteriorly beyond anterior level of the pharynx .. 17
15b. Vitellaria extending anteriorly to at least mid-prepharyngeal level 18
16a. Testes smaller than ventral sucker .... *Gyliauchen zancli* sp. n.
16b. Testes about same size or larger than ventral sucker ..... *Gyliauchen indicum*
17a. Testes dorsal or posterodorsal to ventral sucker ..... *Gyliauchen nahaensis*
17b. Testes anterior or anterodorsal to ventral sucker 19
18a. Vitellaria extensive, evenly distributed in prepharyngeal region, extending anteriorly to near oral sucker .... *Gyliauchen volubilis*
18b. Vitellaria less extensive than above, not evenly distributed in prepharyngeal region, not reaching anteriorly to oral sucker 20
19a. Seminal receptacle about same size or smaller than testes; seminal vesicle saccular and trilobed .. *Gyliauchen tarachodes*
19b. Seminal receptacle usually larger than testes; seminal vesicle tubular and convoluted ..... *Gyliauchen oligoglandulosus*
20a. Chitinous process in genital sinus present . ..... *Gyliauchen ozakii*
20b. Chitinous process in genital sinus absent . 21
21a. Prepharynx shorter than body length; ceca shorter than one-third body length .... *Gyliauchen papillatus*
21b. Prepharynx longer than body length; ceca about one-third body length .... *Gyliauchen parapapillatus* sp. n.

Acknowledgments

The authors extend their thanks to the faculty and staff of the Institute of Marine Resources, University of the South Pacific, Suva, Fiji Islands, particularly to Professor G. Robin South, Director of the Institute, for making the facilities available to the senior author to conduct the study and to Mr. Johnson Seeto for the identification of fish and for his assistance in many other ways. We also thank Dr. J. Ralph Lichtenfels, Biosystematic Parasitology Laboratory, United States Department of Agriculture, Beltsville, Maryland, and Professor Mary Hanson Pritchard of the Harold W. Manter Laboratory, University of Nebraska, Lincoln, for the loan of specimens.

Literature Cited

Barker, S. C., T. H. Cribb, R. A. Bray, and R. D. Adlard. 1994. Host–parasite associations on a coral reef: pomacentrid fishes and digenean trematodes. International Journal for Parasitology 24: 643–647.

Cribb, T. H., R. A. Bray, S. C. Barker, R. D. Adlard, and G. R. Anderson. 1994. Ecology and diversity of digenean trematodes of reef and inshore fishes of Queensland. International Journal for Parasitology 24:851–880.

Durio, W. O., and H. W. Manter. 1969. Some digenetic trematodes of marine fishes of New Caledonia. III. Acanthocolpidae, Haploporidae, Gyliauchenidae, and Cryptogonimidae. Journal of Parasitology 55:293–300.

Dyer, W. G., E. H. Williams, Jr., and L. B. Williams. 1985. Digenetic trematodes of marine fishes of the western and southwestern coasts of Puerto Rico. Proceedings of the Helminthological Society of Washington 52:85–94.

———, ———, **and** ———. 1988. Digenetic trematodes of marine fishes of Okinawa, Japan. Journal of Parasitology 74:638–645.

———, ———, **and**———. 1992. *Homalometron dowgialloi* sp.n. (Homalometridae) from *Haemulon flavolineatum* and additional records of digenetic trematodes of marine fishes in the West Indies. Journal of the Helminthological Society of Washington 59:182–189.

Fischtal, J. H., and R. E. Kuntz. 1964. Digenetic trematodes of fishes from Palawan Island, Philippines. Part I. Families Acanthocopidae, Angiodictyidae, Cryptogonimidae, Fellodistomidae, and Gyliauchenidae. Journal of Parasitology 50: 248–252.

Goto, S. 1919. *Dissotrema* synonymous with *Gyliauchen.* Journal of Parasitology 6:44–47.

———, **and Y. Matsudaira.** 1918. On *Dissotrema papillatum* n.g., n.sp. an amphistomoid parasite from a marine fish. Journal of the College of Science, Imperial University of Tokyo 39:1–19.

Gu, C., and J. Shen. 1979. Ten new species of digenetic trematodes of marine fishes. Acta Zootaxonomica Sinica 4:342–355.

Gupta, S. P., and V. L. Tandon. 1985. On some digenetic trematodes from marine fishes of Puri, Orissa. Indian Journal of Helminthology 35:112–136.

Lester, R. J. G., A. Barnes, and G. Habib. 1985. Parasites of skipjack tuna, *Katsuwonus pelamis*: fishery implications. Fishery Bulletin 83:343–356.

Manter, H. W. 1953. Two new species of Prosorhynchinae (Trematoda: Gasterostomata) from the Fiji Islands. Thapar Commemoration Volume, pp. 193–200.

———. 1957. Host specificity and other host relationships among the digenetic trematodes of marine fishes. First Symposium on Host Specificity among Parasites of Vertebrates, Neuchatel, Switzerland, pp. 185–198.

———. 1961. Studies on digenetic trematodes of fishes of Fiji. I. Families Haplosplanchnidae, Bivesiculidae, and Hemiuridae. Proceedings of the Helminthological Society of Washington 28:67–74.

———. 1963a. Studies on digenetic trematodes of fishes of Fiji. II. Families Lepocreadiidae, Opistholebetidae, and Opecoelidae. Journal of Parasitology 49:99–113.

———. 1963b. Studies on digenetic trematodes of fishes of Fiji. III. Families Acanthocolpidae, Fellodistomatidae, and Cryptogonimidae. Journal of Parasitology 49:443–450.

———. 1963c. Studies on digenetic trematodes of fishes of Fiji. IV. Families Haploporidae, Angiodictyidae, Monorchiidae, and Bucephalidae. Proceedings of the Helminthological Society of Washington 30:224–232.

———. 1967. Some aspects of the geographical distribution of parasites. Journal of Parasitology 53: 1–9.

———, **and D. F. Prince.** 1953. Some monogenetic trematodes of marine fishes from Fiji. Proceedings of the Helminthological Society of Washington 20: 105–112.

Meyers, R. F. 1989. Micronesian Reef Fishes: A Practical Guide to the Identification of the Coral Reef Fishes and of the Tropical Central and Western Pacific. Coral Graphics, Guam. 298 pp.

Nahhas, F. M., and R. M. Cable. 1964. Digenetic and aspidogastrid trematodes from marine fishes of Curacao and Jamaica. Tulane Studies in Zoology 11:169–228.

Nelson, J. S. 1984. Fishes of the World, 2nd. ed. John Wiley and Sons, New York. 523 pp.

Ozaki, Y. 1933. *Telotrema caudatum* n.g., n.sp., ein neuer Typus der Trematodenfamilie Gyliauchenidae (Goto et Matsudaira). Zooligischer Anzeiger 103:329–332.

———. 1936a. *Flagellotrema convolutum* n.g., n.sp., a new trematode of the family Gyliauchenidae. Zoological Magazine, Tokyo 48:951–953.

———. 1936b. Lymph system of *Telotrema caudatum*. Proceedings of the Imperial Academy of Science, Tokyo, Japan 10:380–383.

———. 1937a. Studies on the trematode families Gyliauchenidae and Opistholebetidae, with special reference to lymph system I. Journal of Science of the Hiroshima University, s.B, div. 1 5:125–165.

———. 1937b. Studies on the trematode families Gyliauchenidae and Opistholebetidae II. Journal of Science of the Hiroshima University, s.B, div. 1 5:167–244.

Randall, J. E., G. R. Allen, and R. C. Steene. 1990. Fishes of the Great Barrier Reef and Coral Sea. University of Hawaii Press, Honolulu. 507 pp.

Winter, H. A. 1960. La familia Gyliauchenidae Ozaki, 1933 (Trematoda: Digenea) and redescripcion de *Ichthyotrema vogelsangi* Caballero et Bravo, 1953. Libro Homenaje al Dr. Eduardo Caballero y Caballero, pp. 249–541.

Yamaguti, S. 1934. Studies on the helminth fauna of Japan. Part 2. Trematodes of fishes, I. Japanese Journal of Zoology 5:529–533.

———. 1942. Studies on the helminth fauna of Japan. Part 39. Trematodes of fishes mainly from Naha. Biogeographica: Transactions of the Biogeographical Society of Japan 3:329–398.

———. 1953. Parasitic worms mainly from Celebes. Part 3. Digenetic trematodes of fishes II. Acta Medica, Okayama 8:257–295.